

Hydraulic fracturing pumps are used in over 2/3 of the natural gas retrieval operations in the US. High pressures and corrosive environments encountered during “fracking” can lead to fatigue or stress corrosion cracking failures. The cross-bore regions of the pump fluid ends exposed to pulsating high pressure are particularly vulnerable. Cracks in the cross-bore are hard to detect and can propagate quickly. Failure requires costly replacement, and often even higher expenses of shutting down well production. Fluid ends made of AISI 4340 steels are expected to last as little as 100-500 pumping hours. Current attempts to mitigate this issue include using more expensive stainless steels and decreasing flow throughput, both negatively impacting profit margins.

SOLUTION: Using the highly controlled Controlled Impact Burnishing (CIB™) surface treatment, a deep, stable layer of designed residual compression is applied to the cross-bore regions of fluid ends. The vulnerable surface area is put into compression to a depth deeper than the shallow cracks initiated by stress corrosion or fatigue. The cracks are then arrested, and cannot propagate through the layer of high residual compression to cause failure.

A layer of residual compression over 1mm deep and equal to the compressive yield strength is achieved by CIB in both AISI 4340 steel and 17-4PH stainless steel. CIB provides a five-fold increase in damage tolerance as confirmed by fatigue testing of both alloys. The deep compressive residual stress distribution induced by the CIB process completely mitigates both SCC and fatigue cracking and significantly increases life of these fluid ends.

IMPACT: The engineered use of beneficial residual compression represents a modern way of thinking about production and maintenance support. Introduced seamlessly into existing production lines and requiring no changes to the material or design, CIB is a relatively inexpensive alternative for; improving the life and performance of fluid ends. In addition, CIB application allows the use of higher strength steels without incurring SCC and resists fatigue damage, yielding better profit margins and more product retrieved.

To learn more about how engineered compression can extend the life of your components, contact Lambda Technologies at 1-800-883-0851 or visit our website at www.lambdatechs.com.

